

REMARKS

Claims 1-52 and 60-61 were cancelled in a prior paper. Claims 53-59 were pending in the present application at the time of the Office Action dated April 26, 2004. Claims 55-59 are canceled, claims 53 and 54 have been amended and new claims 62-69 have been added herein.

In the Office Action dated April 26, 2004, the Examiner objected to claim 57 under 37 C.F.R. 1.75(c) as being of improper dependent form for failing to further limit the subject matter of a previous claim. Claims 53-59 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 53-59 were rejected under 35 U.S.C. 103(a) as being unpatentable over Bruxvoort et al. (U.S. 5,958,794).

Applicants disagree with these rejections and wish to clarify various distinctions of applicants' invention over the cited art. Reconsideration of the invention is therefore requested in light of the present amendment and following remarks.

In the remarks that follow, various technical differences between the references cited by the Examiner and the embodiments of the present invention are discussed. It is understood, however, that any discussion involving various embodiments of the invention, which are disclosed in detail in the applicants' specification, do not define the scope or interpretation of any of the claims. Moreover, any discussion of differences between the references cited and the various embodiments of the invention are intended only to help the Examiner to appreciate the importance of the claimed distinctions as they are discussed.

Applicants Embodiments

The disclosed embodiments of the invention will now be discussed in comparison to the applied references. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the subject matter described in the applied references, does not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner appreciate important claim distinctions discussed thereafter.

The invention disclosed in the application is directed to planarizing microelectronic substrate assemblies on fixed abrasive polishing pads with non-abrasive

planarizing solutions. In one aspect of the invention, a lubricating planarizing solution without abrasive particles is deposited onto a fixed-abrasive polishing pad having a body, a planarizing surface on the body, and a plurality of abrasive particles fixedly attached to the body at the planarizing surface. The front face of a substrate is pressed against the lubricating planarizing solution and at least a portion of the planarizing surface of the polishing pad. At least one of the polishing pad or the substrate assembly is then moved with respect to the other to impart relative motion therebetween. As the substrate assembly moves relative to the polishing pad, regions of the front face are separated from the abrasive particles in the polishing pad by a lubricant-additive in the planarizing solution.

In one particular application, regions of the front face of the substrate are separated from the abrasive particles by dissolving the lubricant-additive into a non-abrasive solution to form the lubricating planarizing solution, and then depositing the lubricating planarizing fluid onto the polishing pad as the substrate moves relative to the polishing pad. In certain embodiments, the particular lubricant found to be most suitable for planarization is CARBOPOL (manufactured by B.F. Goodrich). In a prior response to a prior office action, the specification was amended to recite the essential chemical component in CARBOPOL, which is comprised of homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether.

On pages 8 and 9 of the specification the concentration of the lubricant-additive in the non-abrasive solution is selected so that the lubricating planarizing solution has a viscosity of at least approximately 4-100 cp, and more generally 10-20 cp. Those pages also describe particular concentrations of CARBOPOL which advantageously should be present in an amount of 0.1 to 10% with an exemplary embodiment having a concentration of only 0.25%.

In contrast to what the Examiner has asserted, the specification as a whole discusses viscosity as being the important feature (*i.e.*, the critical feature) that should be addressed in forming a lubricating planarizing solution for chemical mechanical planarization. The lubricating planarizing solution provides a protective boundary layer between the front face of the substrate and the abrasive planarizing surface to inhibit the fixed abrasive from overly abrading or otherwise damaging the substrate. Although not expressly stated in the specification, one of ordinary skill in the art who is familiar with CMP using fixed abrasive pads will infer from Applicants' teaching as a whole, that if the viscosity is too low, the lubricating planarizing

solution will not be adequate to provides a protective boundary layer between the front face of the substrate and the abrasive planarizing surface. Similarly, if the viscosity is too great other adverse affects may occur, such as introduction of bubbles into the media between the pad and the substrate or requiring excess energy and therefore heat build up during the planarization process.

The Cited Art

Bruxvoort does not disclose the species of lubricants that Applicants disclose.

The section of Bruxvoort at column 13 cited by the Examiner states:

Examples of suitable lubricants include metal salts of fatty acids (e.g., zinc stearate, calcium stearate and lithium stearate), graphite, mica, molybdenum disulfide, talc, polyamides, boron nitride, sulfides, waxes, glycol ethers, glycerine, silicone compounds, polyvinyl acetate, polyvinyl alcohols, ethylene oxide polymers (e.g., polymers commercially available under the trade designation "Polyox" from Union Carbide Corp.), combinations thereof and the like. (col 13, lines 23-30).

The Examiner is requested to note that neither polypropylene glycol or CARBOPOL (or its chemical constituent, which is homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether) are taught by Bruxvoort. Notwithstanding the differences or similarities between polyethylene glycol and polypropylene glycol, Applicants cannot find - and the Examiner has not provided - any rational of why CARBOPOL would be suggested from the teaching Bruxvoort. CARBOPOL is considerably different in chemical structure from any of the compositions mentioned by Bruxvoort. CARBOPOL provides the unexpected advantage in that it can be used at very low concentrations, (e.g., about 0.1% wt/wt) and over a large concentration range (0.1% to 10%) to obtain the requisite viscosity taught by Applicants.

Notwithstanding whether Examiner and the reference to Reidmeyer are technically correct in stating that glycerol, polyethylene glycol, and polypropylene glycol are all polyhydric alcohols, it is certainly true that CARBOPOL is not a polyhydric alcohol. A polyhydric alcohol is "An alcohol with many hydroxyl (-OH) radicals such as glycerol $C_3H_5(OH_3)$. Also known as polyalcohol. Polyol." *McGraw Hill Dictionary of Scientific and Technical Terms*. CARBOPOL on the other hand is comprised of homopolymers and

copolymers of acrylic acid crosslinked with a polyalkenyl polyether. As such, CARBOPOL does not contain many alcohol radicals like a polyhydric alcohol.

The Examiners statement that they “all have similar lubricating characteristics” is not correct especially with respect to CARBOPOL. It is Applicants not Bruxvoort who disclose that in the context of chemical mechanical planarization, that CARBOPOL (unlike the other embodiments disclosed in Applicants’ specification) has particularly desirable characteristics with respect to the critical parameter of viscosity being achievable at the very low amounts and wide ranges disclosed. There is nothing in Bruxvoort that teaches that any of the laundry list of compounds have similar lubricating characteristics let alone similar viscosities as CARBOPOL. Indeed, the lubricating characteristics of the compounds mentioned by Bruxvoort, include such diverse species as graphite, talc and mica, each of which are particulate solids that certainly would not be similar to the lubricating characteristics of CARBOPOL.

Without a specific teaching as to why one would or should select one compound over another or the characteristics of those compounds, there is nothing in Bruxvoort that would motivate one of ordinary skill in the art to specifically use CARBOPOL, which is not among the lubricants in the list nor is similar in structure to the compounds listed by Bruxvoort. At best the Bruxvoort laundry list amounts to an “invitation to try” or an “invitation to experiment” with a large and diverse category of possible compositions for different purposes. Such an invitation to experiment without a specific teaching or guidance as to what to achieve cannot fairly be said to suggest use of specific compound such as CARBOPOL not even included in the list.

With respect to viscosity, Bruxvoort provides no teaching or suggestion that viscosity is an issue to consider. As mentioned above, Bruxvoort provides no guidance on what compounds to select, nor any guidance as to the amounts or properties that are important for lubrication during chemical mechanical planarization. It is Applicants, that recognize that viscosity is a critical property in lubrication during CMP and it is Applicants who provide the needed guidance to make effective planarizing solutions that combine ammonia and water specifically with CARBOPOL.

The Claims and Rejections

Turning now to the claims and the rejections thereof, claim 53 has been amended to specifically recite a lubricant comprising homopolymers and copolymers of acrylic acid

crosslinked with a polyalkenyl polyether, which is the chemical species ion CARBOPOL. Nothing similar to this lubricant is disclosed or suggested by Bruxvoort. Moreover, CARBOPOL provides the unexpected advantage of being suitable for use in much lower concentrations (as low as 0.1%) and in concentrations over a 100 fold range (0.1% to 10%) than glycerol, or polyethylene glycol which require at least 5% and a range of only 4 fold (5% to 20%) The Examiner has not provided any reference nor made any argument whatsoever as to why use of CARBOPOL would be obvious over Bruxvoort. To establish a *prima facie* case of obviousness, the cited references must provide a teaching or suggestion *in the reference*, that would motivate one of ordinary skill in the art to make a composition having each and every element in the claims. There is no such teaching or suggestion in Bruxvoort with respect to CARBOPOL. Accordingly, Applicants request withdrawal of the rejection of amended claim 53 and its dependents on grounds of obviousness.

The amendment to the claims and the new claims, which are supported in the specification, do not add any new matter because the composition now recited by chemical name is the same as the composition originally disclosed by the trade name CARBOPOL. The new and amended claims are all sub species of the originally submitted claims and therefore do not necessitate any new grounds of consideration because the last amendment provided the definition of the chemical species in CARBOPOL. Entry of the amendment to the claims is therefore respectfully requested not only because the amendment puts the application in condition for allowance but also because, if the Examiner disagrees, the amendment places the claims in better condition for appeal.

With respect to the rejections under section 112 for reciting "approximately", Applicants respectfully submit that this term, as originally recited in the claims is common in chemical composition claims. Moreover claims with such language appear in many issued patents and have survived scrutiny on grounds of indefiniteness because the ordinarily skilled person appreciates that making mixtures typically involves various amounts of imprecision in measurement. However, to expedite prosecution of certain embodiments of the invention, Applicants have amended the claims to remove the recitation of "approximately." The amendment is not for reasons substantially related to patentability because a value near to, but not exactly within the limits in viscosity as recited in the present claims is still within the scope

of the term "approximately" as originally recited in the claims to the extent the composition works substantially the way as any composition squarely within the recited ranges.

The objection to claim 57 is moot in view of cancellation of that claim. The rejection on grounds of indefiniteness for reciting the trade name CARBOPOL is moot in view of the amendment substituting the relevant chemical component contained therein. Accordingly, the rejections under section 112, second paragraph should be withdrawn.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
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